

NEW SPECIES OF CULICOIDES FROM WISCONSIN^{1, 2}

(DIPTERA, HELEIDAE)

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Wisconsin material belonging to the genus *Culicoides* was divided into 27 distinct specific groupings. Nineteen of these were previously described species. Of the remaining eight, three are herein described as new species. The residual five are not treated at this time as they are based on female material only and all but one of them is represented by only a few specimens. The female of *C. stilobezzioides* Foote and Pratt is here described for the first time. This species was previously known only from two male specimens collected in the state of New York. The characters used in the key to adult females give complete and definite identification for all but two of the included species. As indicated in the key, *C. spinosus* Root and Hoffman apparently consists of a complex of two species. *C. piliferus* Root and Hoffman is composed of a complex of three or more species insofar as can be ascertained from the Wisconsin material at hand. Only the reared material of this species has been definitely identified as *piliferus*. The holotypes and allotypes have been deposited in the U. S. National Museum. Paratypes have been placed in the following collections: U. S. National Museum (USNM), University of Wisconsin (UW), State College of Washington (WSC), Illinois State Natural History Survey (ISNHS), and in the author's collection (RHJ).

KEY TO WISCONSIN SPECIES OF CULICOIDES⁴—ADULT FEMALES

1. Wings without light or dark markings, the area of the radial cells sometimes somewhat darker.....*stilobezzioides* Foote and Pratt
- Wings with at least two anterior light spots..... 2
2. (1) Second radial cell included mainly in a light spot 3
- Second radial cell included mainly in a dark spot 5
3. (2) Vein Cu₂ lying in a narrow light spot for its entire length.....
-*venustus* Hoff.
- Vein Cu₂ lying in a dark area, not bordered by a light spot..... 4
4. (3) Macrotrichiae present only on the distal half of wing, cell Cu₁ almost entirely an indistinct light spot.....*obsoletus* (Meig.)

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³The bulk of this work was performed at the University of Wisconsin, Madison, and in the U. S. National Museum, Washington, D. C.

⁴Based primarily on structural characters, necessitating slide preparations.

- Macrotrichiae also abundant basad of radial cells; cell Cu_1 almost entirely a distinct light spot, usually having a small dark spot in its center.....*yukonensis* Hoff.
5. (2) 1 spermatheca6
 2 or 3 spermathecae (if 3, aberrant of 2 spermathecae, rudimentary developed)9
6. (5) Spermatheca elongate and curved horseshoe-like.....*variipennis* (Coq.)
 Spermatheca round or oval.....7
7. (6) Eyes widely separated, the closest facets across interocular space very widely separated. Wings with only two anterior light spots, or with additional ones indistinct.....*wisconsinensis* n. sp.
 Eyes narrowly separated. Wings with distinct light spots in addition to the anterior two8
8. (7) AR from 1.8 to 2.0, antennal segment 11 distinctly longer than segments 9 and 10 combined (measured together) and equal to at least $2\frac{1}{2}$ of the preceding segments. Wings with no trace of light spots in tips of cells R_5 , M_1 , and M_2 ; no light spots present in cell M_2 at position under the end of the radial cells.....*sphagnumensis* Williams
 AR from 1.2 to 1.7, antennal segment 11 shorter than or subequal to the length of segments 9 and 10 combined. Wings with light spots present in the tips of one or more of cells R_5 , M_1 , and M_2 , usually a distinct light spot present in all of these cells distally; a light spot present in cell M_2 at position under the end of the radial cells.....*crepuscularis* Mall.
9. (5) Wings with three light spots along the anterior margin in cell R_5*stellifer* (Coq.)
 Wings with two or less light spots present in cell R_510
10. (9) Wings with two light spots present in cell R_5 , the distal one small and placed at extreme posterior tip of cell.....*haematopotus* Mall.
 Wings with less than two light spots in cell R_5 ; or if two light spots are present, the distal one is situated at the center of the cell, if situated at apex it is large and extends well basad.....11
11. (10) Antennal segment 11 subequal to or longer than segments 9 and 10 combined (measured together), the ratio of 9 plus 10 over 11 being 1.0 (range 0.9 to 1.2); antennal segments 4 to 10 distinctly longer than wide12
 Antennal segment 11 distinctly shorter than segments 9 and 10 combined (measured together), the ratio of 9 plus 10 over 11 being from 1.3 to 2.0 (range 1.3 to 2.0); antennal segments 4 to 10 rounded or longer than wide.....15
12. (11) Hind tibiae of uniform color, lacking the distinct broad apical light band in contrast to a dark center portion.....*travisi* Vargas
 Hind tibiae distinctly banded, having narrow basal and broad apical light bands with the center portion distinctly darkened.....13
13. (12) Wings with vein Cu_2 lying in a narrow light area or ending in a light spot.....*arboricola* R. & H.
 Wings with vein Cu_2 lying completely in a dark area.....14

14. (13) Wings with the light spot on crossvein large, extending well past vein M posteriorly *guttipennis* (Coq.)
 Wings with the light spot on crossvein small, usually not reaching or barely touching vein M posteriorly *villosipennis* R. & H.
15. (11) Wings with the distal light spot in cell R_5 double *bauceri* Hoff.
 Wings with the distal light spot in cell R_5 single or absent 16
16. (15) Antennal segment 11 equal to or scarcely longer than segment 10.
 Wings with distinct light spots, distal one in cell R_5 large and situated at the middle of cell *dickei* n. sp.
 Antennal segment 11 distinctly longer than segment 10. Wings variously marked with light spots 17
17. (16) Third palpal segment greatly swollen with a very distinct, deep, small sensory pit. Wings with light spots in addition to the two anterior ones present only along the posterior margin of the wing, the central disc of wing devoid of light spots *nanus* R. & H.
 Third palpal segment not greatly swollen and without a distinct, deep, small sensory pit; or wings with additional light spots present on the central disc 18
18. (17) Mandibles with 11 or less teeth distally. Proboscis tapering to a small apex; mandibles usually indistinct, the narrow serrate tips frequently not visible 19
 Mandibles distinctly with 13 or more teeth. Proboscis only slightly tapered, the apex usually rather broad; mandibles distinct, the broad serrate tips always visible under high power 21
19. (18) Hind tibiae distinctly banded, the center dark with narrow basal and broad apical light bands. Third palpal segment very short, somewhat swollen, subequal in length to tenth antennal segment *flukei* n. sp.
 Hind tibiae lacking the broad apical light band in contrast to dark center portion. Third palpal segment distinctly longer than tenth antennal segment 20
20. (19) Tip of labrum with a distal membranous projection, this always visible and bearing several distinct hairs apically. Mandibles with 4 to 6 teeth *unicolor* (Coq.)
 Tip of labrum without this distal membranous projection. Mandibles with 8 or more teeth (*spinus* will key out in both sides of couplet no. 18, the form with few mandibular teeth possibly being a species distinct from the true form with more than 13 teeth (see couplet 22) *spinus* R. & H.
21. (18) Spermathecae typical, having a distinct, sclerotized, broadened neck 22
 Spermathecae without a distinct broadened neck; the short sclerotized portion of the duct adjacent to the spermathecae proper having parallel sides *piliferus* R. & H.
22. (21) Wings with only two anterior light spots. Spermathecae heavily sclerotized, ring usually distinctly present *biguttatus* (Coq.)
 Wings with additional light spots present besides the anterior two, these usually distinct in at least anal cell and cell Cu_1 . Spermathecae lightly sclerotized, ring very faint or absent. (see couplet 20) *spinus* R. & H.

Culicoides dickei, new species⁵

(Figs. 1, 2, 3, 4, 5)

A small species, mesonotal disc with moderately distinct pattern; wings with the second radial cell included in a dark spot, with distinct light spots in addition to the anterior two, distal light spot in cell R_5 at middle of cell, far from apex; hind tibiae with distinct light banding; antennal segment 11 subequal in length to segment 10.

Female.—Wing length 1.1 mm., width 0.5 mm.

Eyes narrowly separated. AR 0.8, antennal segments 4 to 10 longer than wide, segment 11 subequal in length to segment 10, segments 11 to 15 in ratio of 1, 1.0, 1.1, 1.2, 1.8. Third palpal segment (fig. 5) slightly swollen with a medium sized, shallow sensory pit. Proboscis short, mandibles with 7 or 8 teeth distally.

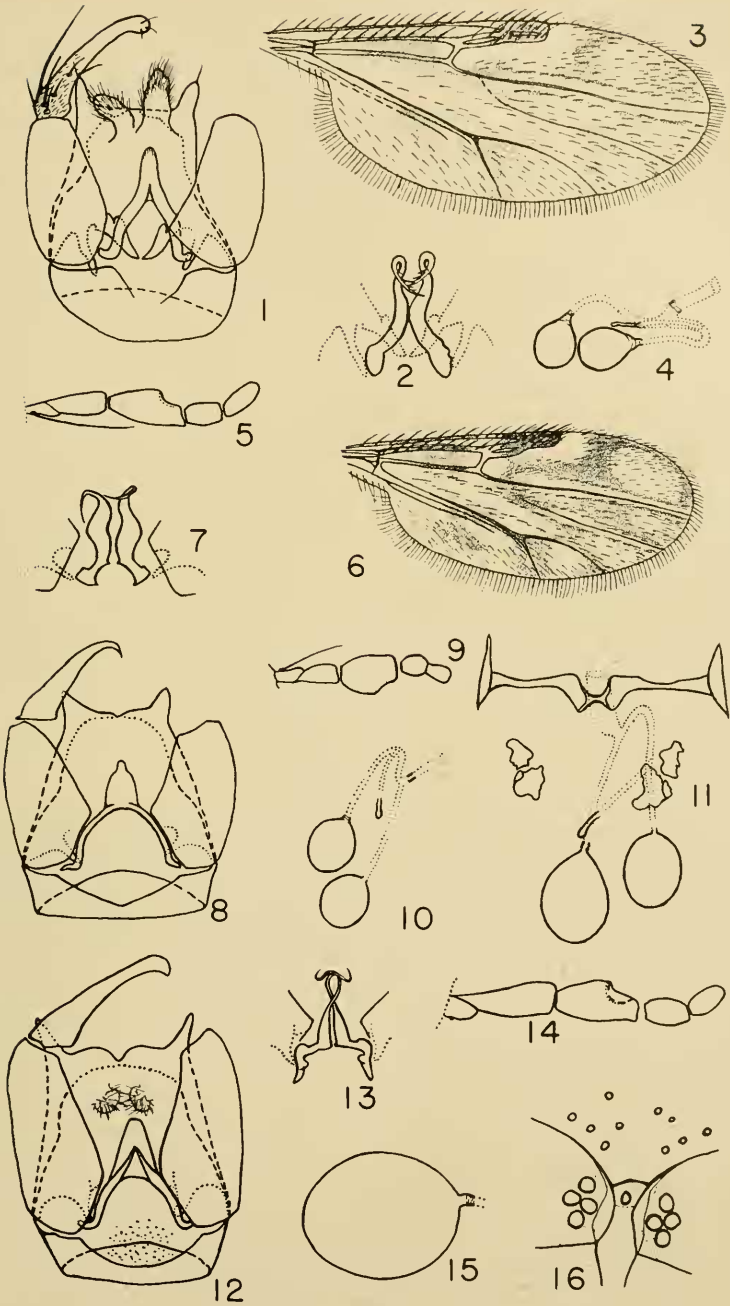
Mesonotal disc with moderately distinct pattern of dark markings: area between humeral pits dark and giving rise to three broad dark bars posteriorly; one on median line, narrowing at the proscutellar depression; and a lateral one on each side, extending obliquely outwards from humeral pits to posterior level of the distinct presentellar dark spots where they join laterally with dark areas along sides; these lateral dark bars joined laterally to sides at about their midpoint, thus defining two large light areas on each side. Anterolateral corners light colored, bordered posteriorly by a narrow dark line directed laterally from each humeral pit. Scutellum somewhat darkened centrally. Legs brown with distinct light banding; knees dark with distinct, narrow light bands based and distad to them, the apical one on hind femora indistinct; hind tibiae with distinct, broad, apical light band. Tibial comb with 4 large spines.

Wing (fig. 3) with second radial cell included in a dark spot; macrotrichiae sparse, denser in cell R_5 and at apex of wing. Wing light brown with the following distinct light spots: on crossvein, extending anteriorly to costa and posteriorly to or slightly through vein M; at tip of radial cells, extending posteriorly to the fold above vein M_1 ; a large light spot in cell R_5 , situated centrally between the radial cells and apex of wing; a small one distally in cell M_1 and another in cell M_2 , the one in cell M_1 well separated from wing margin; a light spot based in cell M_1 , this indistinctly joined with the light area posterior to it in cell M_2 , the basal portion of cell M_2 mainly a light area; and anal cell primarily a light area, divided into two transverse parts by a central darker area which does not distinctly attain posterior margin of wing. Crossvein light colored. Halteres with stem and basal part of knob browned, the apical portion of knob light yellow.

Spermathecae (fig. 4) two, oval, with distinct, broadened necks. Rudimentary spermatheca and ring present. Abdomen brown, cerci a lighter brown.

Male.—Similar to female, genitalia (figs. 1, 2). Ninth sternite emarginate,

⁵The author takes pleasure in naming this species after Dr. Robert J. Dicke. His interest in these flies initiated the author's study of them.



appearing cleft in some specimens, the membrane not spiculate. Ninth tergite with stout, well developed apicolateral processes, the apex slightly notched. Dististyles straight with slightly enlarged, rounded apices. Basistyles with inner margins straight, without patch of distinct spines; ventral roots stout and boat-hook shaped, the posterior projection short; dorsal roots straight, moderately stout and long. Aedeagus not distinctive, stout and more or less V-shaped, the apex broadly rounded. Parameres slightly divergent basally, stout for greater part of length, tapering into the slender, haired, recurved tips.

Types.—Wisconsin, Washburn Co., T39N-R12W-S32, light trap, R. H. Jones. *Holotype* ♀: 19-VI-1953 (pin, USNM). *Allotype* ♂: 23-VI-1952 (Jones No. 534, pin-slide, USNM). *Paratypes* 26 ♀♀ and 4 ♂♂: 1 ♀, 23-VI-1952 (Jones No. 679, alcohol-slide, RHJ); 18 ♀♀, 24-VI-1952 (Jones Nos. 731-2, alcohol-slide, 731 UW, 732 RHJ) (Jones Nos. 2194-5 & 2269, PD-slide⁶, 2195 USNM, 2194 & 2269 UM) (alcohol, 1 WSC, 1 ISNHS, 9 USNM, 2 RHJ); 2 ♀♀, 29-VI-1952 (Jones No. 2261, PD-slide, UW) (alcohol, USNM); 1 ♀, 2-VII-1952 (pin, USNM); 2 ♀♀, 3-VII-1952 (pin, RHJ) (alcohol, USNM); 1 ♀, 7-VII-1952 (alcohol, UW); 1 ♀, 16-VI-1953 (pin, USNM, 2 ♂♂, 13-VI-1952 (Jones Nos. 442-3, pin-vial, 442 USNM, 443 RHJ); 1 ♂, 24-VI-1952 (Jones No. 686, alcohol-slide, UW); and 1 ♂, 19-VI-1953 (Jones No. 2144, pin-slide, USNM).

According to Wirth (personal communication), this species belongs to a group well represented in the Neotropical region by *debilipalpis* Lutz and other species. It is apparently not closely related to any of the other species occurring in Wisconsin.

Culicoides flukei, new species ⁷

(Figs. 6, 7, 8, 9, 10)

A small species, mesonotum with distinct pattern; wings with second radial cell included in a dark spot, with distinct light spots in addition to anterior two; hind tibiae with distinct light banding; antennal segment 11 distinctly shorter than segments 9 and 10 combined; proboscis short with few teeth distally on mandible.

Female.—Wing length 0.9 mm., width 0.4 mm.

Eyes contiguous or very narrowly separated. AR 1.1, antennal segments 4 to 10 longer than wide, segment 11 distinctly shorter than segments 9 and 10 combined, segments 11 to 15 in ratio of 1, 1.0, 1.1, 1.3, 1.7. Third palpal segment (fig. 9) moderately swollen, short, subequal in length to antennal segment 10, with a small, indistinct, moderately deep sensory pit; the palpi very short with indistinctly defined segments. Proboscis very short, narrow apically; mandibles with 8 teeth distally.

⁶PD is abbreviation for pin-dioxane, the thorax of specimens were taken through dioxane and pinned, the original collection alcoholic.

⁷The author takes pleasure in naming this species after Dr. Charles L. Fluke, who first stimulated the author's interest in the taxonomy of Diptera.

Mesonotal disc with a distinct pattern of dark markings which are so joined that they enclose the following distinct light areas: two oval, longitudinal spots narrowly separated by the dark median line, lying between anterior margin of disc and prescutellar depression; two lateral light areas on each side in a longitudinal line, the anterior pair more rounded and directed obliquely towards the humeral pits, the posterior pair elongate; the distinct prescutellar dark spots lying in a lighter area on each side of an indistinct median dark line; and the anterolateral corners distinctly light colored. Scutellum dark, with 4 large marginal and a number of smaller bristles. Legs dark brown with distinct light banding; knees dark with distinct, narrow light bands basad and distad to them, except for the hind femora where the apical light band is indistinct; tibiae with broad, apical light bands, very distinct on hind legs; tarsi light, hind basitarsus darkened. Tibial comb with 5 large spines.

Wing (fig. 6) with radial cells included in a dark spot; macrotrichiae rather sparse, evenly distributed. Wing dark brown with the following distinct light spots: a large rounded one on crossvein, extending anteriorly to costa and posteriorly slightly through vein M; a large spot at tip of radial cells, extending posteriorly almost to light area bordering vein M_1 ; a large light spot distally in cell R_5 ; two smaller spots at apex of wing, one in cell M_1 and another in cell M_2 ; a light spot in cell Cu_1 occupying most of center of cell, extending from vein Cu_1 anteriorly to posterior margin of wing; one in anal cell under MC fork; vein M_2 bordered by a short light spot centrally; vein M_1 bordered by a light spot originating under second radial cell, continuing narrowly to apex of wing; a small light spot above the MC fork, cell M_2 indistinctly light between this spot and one on crossvein; and the basal portion of wing light, this extending along posterior margin in anal cell to the light spot under MC fork. Crossvein yellowish in contrast to surrounding light spot. Halteres white, base of knob and stem browned.

Spermathecae (fig. 10) two, almost round, without a distinct neck, ducts sclerotized for short distance at juncture with spermathecae. Rudimentary spermatheca and ring present. Abdomen dark brown with distinctly darker sides, cerci light yellow.

Male.—Similar to female, genitalia (figs. 7, 8). Ninth sternite broadly emarginate, the membrane not spiculate. Ninth tergite with stout, well developed apicolateral processes, the apex slightly notched. Dististyles straight, evenly tapering to the internally curved, pointed apices. Basistyles with inner margins straight and without patch of distinct spines; ventral roots absent, dorsal roots short and relatively slender. Aedeagus with basal arms slender and arched in an even curve; apical portion broad for most of length, distally suddenly tapering to small blunt, nipple-like apex. Parameres with basal ends angled outward at about 45° , the basal tips enlarged; stem above basal angulation swollen and sinuate, tapering to the slender, recurved, bare tips.

Types.—Wisconsin, Dane Co., T7N-R9E-S16, R. H. Jones, 1954, reared from sugar maple treehole (with pupal exuvia unless otherwise noted). Holotype ♀: 30-V (pin, USNM). Allotype ♂: 30-V (Jones No. 2748, pin-slide, USNM). Paratypes 24 ♀♀ and 19 ♂♂: 1 ♀, 30-V, without exuvia (Jones No. 2744, pin-slide, RHJ); 2 ♀♀,

30-V (Jones No. 2758, pin-slide, RHJ) (pin, UW); 1 ♀, 11-VI (alcohol, UW); 7 ♀♀, 11-VI, with pupal and last larval exuviae (Jones Nos. 2770-4, 2777, & 2766, alcohol-slide; 2770-2 & 2774 USNM, 2773 RHJ, 2766 & 2777 UW); 2 ♀♀, 26-VI with pupal and last larval exuviae (Jones Nos. 2783-4, 2 slides; 2783 RHJ, 2784 UW); 11 ♀♀, 26-VI (alcohol; 5 USNM, 4 RHJ, 1 WSC, 1 ISHNS); 3 ♂♂, 11-VI, with pupal and last larval exuviae (Jones No. 2763, alcohol-slide, USNM) (Jones Nos. 2764-5, 2 slides, RHJ); 8 ♂♂, 11-VI (Jones Nos. 2767-9, pin-slide; 2767-8 UW, 2769 WSC) (alcohol, 5 USNM); 8 ♂♂, 26-VI (alcohol; 4 UW, 3 RHJ, 1 ISHNS).

A small treehole species closely related to *guttipennis* (Coq.).

Culicoides wisconsinensis, new species

(Figs. 12, 13, 14, 15, 16)

A medium sized species, mesonotum with distinct pattern; wings with second radial cell included in a dark spot, with indistinct or no light spots in addition to the anterior two; one spermatheca; eyes widely separated.

Female.—Wing length 1.2 mm., width 0.5 mm.

Eyes (fig. 16) widely separated by a distance exceeding diameter of one facet, the closest facets across interocular space exceeding twice this diameter. AR 1.1, segments 4 to 10 longer than wide, segment 11 distinctly shorter than segments 9 and 10 combined, segments 11 to 15 in ratio of 1, 1.0, 1.1, 1.2, 1.6. Third palpal segment (fig. 14) slightly swollen with a medium sized, shallow sensory pit. Mandibles with 8 or 9 teeth distally.

Mesonotal disc pattern of distinct type, the definition obscure in specimens available. The two prescutellar dark spots distinct. Scutellum lighter laterally, with 5 large marginal and about 8 scattered smaller bristles. Legs brown, with indistinct, narrow lighter bands setting off the darkened knees. Tibial comb with 4 large spines.

Wing with second radial cell included in dark spot, macrotrichiae abundant over whole surface. Wing brown, area of radial cells and beyond light spot at tip of darker. Light spots very variable in specimens available, the two anterior light spots small and distinct; paratype (Jones No. 2117) with no additional light spots, other specimens with from indistinct to relatively distinct light spots present in varying numbers; holotype with most present as follows: two in anal cell, one at base and another small one under MC fork; and with light spots present along wing margin in cells Cu_1 , M_1 , and R_5 , those at apices of cells M_1 and R_5 well separated from wing margin. Crossvein indistinct to slightly darker than surrounding light spot. Halteres white, the stem and base of knob browned.

Spermatheca (fig. 15) one, large and rounded, lightly sclerotized; duct with a distinct, moderately long, parallel sided, sclerotized portion adjoining spermatheca. Rudimentary spermatheca and ring absent.

Male.—Similar to female, genitalia (Figs. 12, 13). Very close to *crepuscularis* Malloch, the only apparent difference being in the parameres. Parameres with their bases turned outwards at close to 90°, the internal margin of the foot-like basal part deeply concave and with irregular contour; the main stem not at all swollen, tapering evenly into the slender, recurved, bare tips.

Types.—Wisconsin, Dane Co. *Holotype* ♀: T7N-R9E-S7, R. H. Jones, 4-X-1953, reared from peat muck edge of Lake Mendota, with pupal exuvia (Jones No. 2894, pin-slide USNM). *Allotype* ♂: same data as holotype (Jones No. 2043, pin-slide, USNM). *Paratypes* 3 ♀♀ and 8 ♂♂: 1 ♀, same data as holotype (Jones No. 2117, 2 slides, UW); 1 ♀, same data as holotype except 20-V-1954 and with pupal and last larval exuviae (Jones No. 2660, pin-2 slides, USNM); 6 ♂♂, same data as holotype (1, pin, USNM) (Jones No. 2031, pin-2 slides, UW) (Jones Nos. 2024 & 2034, pin-slide; 2024 RHJ, 2034 UW) (Jones Nos. 2122-3, alcohol-2 slides; 2122 USNM, 2123 RHJ); 1 ♂, same data as holotype except with pupal and last larval exuviae (Jones No. 2036, pin-slide, USNM); 1 ♂, same data as holotype except 20-V-1954 (Jones No. 2673, pin-slide, WSC); and 1 ♀, T-7N-R9E-S27-B2, R. J. Dicke, 17-VI-1954, light trap no. 4 (Jones No. 2918, alcohol-slide, RHJ). *Paratypic genitalia and pupal cases*: 2 ♂♂, same data as holotype (Jones Nos. 2056-7, slide, UW).

This species is closely related to *crepuscularis* Malloch.

***Culicoides stilobezzioides* Foote and Pratt**

(Fig. 11)

Culicoides stilobezzioides Foote and Pratt, 1954, U. S. Public Health Monogr. No. 18:83.

A medium sized species, mesonotal disc without pattern; wings without light or dark markings; antennal segment 11 distinctly longer than segments 9 and 10 combined, segments 4 to 10 rounded; two spermathecae, with heavily sclerotized processes internally in region of spermathecae; parameres with long delicate hairs distally.

Female.—Wing length 1.5 mm., width 0.7 mm.

Eyes narrowly separated. AR 1.8, antennal segments 4 to 10 rounded, segment 11 distinctly longer than segments 9 and 10 combined, segments 11 to 15 in ratio of 1, 1.1, 1.1, 1.1, 1.6. Third palpal segment greatly swollen with a small, deep sensory pit. Mandibles with 16 teeth distally.

Mesonotal disc without a distinct pattern; three, longitudinal, narrow, darker lines usually visible in alcoholic material. Anterolateral corners light colored, prescutellar dark spots absent, area adjacent to scutellum broadly darkened. Scutellum concolorous brown with disc, with 7 large marginal and about 20 scattered smaller bristles. Legs dark brown, fore coxae and trochanters yellowed. Tibial comb with 5 large spines.

Wings without light or dark markings, the area of radial cells somewhat darker, macrotrichiae abundant over whole surface. Crossvein brown. Halteres brown, the apical portion of knob white to yellow.

Spermathecae (fig. 11) two, oval, ducts at most sclerotized for short distance at juncture with spermathecae. Rudimentary spermatheca present, ring absent. Unusual in possessing distinct, heavily sclerotized processes internally in a lateral position midway between the spermathecae and the bursa, these without any apparent connection to spermathecal system. Abdomen and cerci brown.

Allotype ♀: Wisconsin, Dane Co., T8N-R9E-S26-B4, R. J. Dicke, 9-VI-1954, light trap no. 8. *Additional specimens*: 548 ♀♀ and 155 ♂♂.